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ABSTRACT

This paper describes a Web site containing activities for chemistry that aid student learning. Used as an adjunct to the normal classroom and laboratory sessions, instructional goals of the Web site were to provide guidance and encourage regular and timely study. Initially learners were able to review the weekly objectives, see short explanations or demonstrations of objectives, then attempt short-answer questions. Eventually, weekly online assignments were introduced. (SAH)

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ADDING VALUE: USING ON-LINE ACTIVITIES TO ENSURE STUDENT SUCCESS

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INTRODUCTION

Since the introduction of the World Wide Web faculty have been quick to adapt it as a convenient method for disseminating information to students. Early web efforts showed a plethora of "course outlines on-line" where basic course information, schedules, instructor contacts and references to required textbooks were the norm. Sites often included hot-links to related information available on the web. Student bulletin boards or discussion forums were often included more as a novelty, than with any particular planned use.

Given the time requirements for faculty to develop course web sites, it seems imperative that some reasonable return be expected of this investment. At the British Columbia Institute of Technology a simple instructional design question was posed in the early stages of the development of a Chemistry course web-site. "What should a web site do for the learners, so that usage of the web site becomes a valuable addition to study habits, and a major factor in shaping their success in Chemistry and other courses?"

Rising to this challenge, the developer of BCIT's pre-entry Chemisty course web site (http://nobel.scas.bcit.bc.ca/chemconf98/0010/) created web activities which the authors feel contributed to the students' success. Used as an adjunct to the normal classroom and laboratory sessions, instructional goals of the web site were to provide guidance and to encourage regular and timely study. Initially learners were able to review the weekly objectives, see short explanations or demonstrations of objectives, then attempt short answer questions. Eventually, weekly on-line assignments were introduced. These integrated new material from the week?s objectives with material covered previously. Learners soon realized the fruit of their labours and began to have expectations for success as a reward for appropriate study activities and effort.

BACKGROUND

The pre-entry program at BCIT offers an opportunity to mature learners to prepare academically for admission into a two-year technology diploma program. Learners are given instruction in pre-requisite areas such as computer literacy, mathematics, physics, chemistry and communications. While the academic level of the subject matter is akin to that of secondary school, the pre-entry program presents the topics with the same intense pace and expectations of the regular technology programs. This is carried out to let learners become accustomed to the routine of full-time study and to prepare their study skills, personal organization and expectations for the rigors ahead. Classes in the pre-entry Chemistry course tend to be small, having between 6 to 15 registrants per offering.

The very nature of the pre-entry program attracts learners who may be considered at risk for academic failure or withdrawal from courses. In developing a web site to support the lecture and laboratories of the pre-entry Chemistry course, care was taken to include activities which would encourage timely and

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regular study. The web site was organized along the class schedule. For each class and laboratory session an effort was made to: 1. state explicitly each learning objective, 2. provide an explicit model of each objective, 3. provide sample questions with remedial information, 4. focus remediation on reviewing learning materials (e.g. text book, Lab workbook or course notes)familiar to the learners, and 5. adding interactive self-tests which provide examination practice as well as feedback results to both instructor and students 6. provide dynamic retrieval of course marks to track progress 7. provide an incentive to participate (10% of course mark)

The web site also provided a number of ready reference tools (e.g. periodic table, chemical data tables) for student use in working through self-tests, and linked to several on-line resources for enrichment or interest. A detailed explanation of the site organization is found in Fong(1998).

WEB SITE EVOLUTION

The web site and its integration with the Chemistry course evolved over a period of three years from 1996 to the present. Initially, the site provided a course outline, sample questions, a number of Chemist's tools and references links to related sites. The students were given a demonstration of the site and allowed Internet access from campus computer labs but usage was on a voluntary basis. In 1996 few students had home computers with Internet service. Student response was positive and most students accessed the site at least once each week.

To overcome the lack of access to the Internet, a web tutorial session was introduced with the course's next offering in the 1997 winter term. A weekly tutorial was held in a computer lab to enable access to the web site study guide as an optional activity. In the 1997 summer term a weekly on-line assignment was added to the site and valued at 10% of the course mark. Students continued to use the study guide to follow along with the class content, but the weekly assignment also covered material from the beginning of the term. Since the purpose of the study guide and assignment was to encourage mastery learning, students who were unhappy with their mark in the weekly assignment were encouraged to print it out, take it home for the weekend and submit it on paper for re-marking.

DOES IT MAKE A DIFFERENCE?

Table 1 shows the student marks for the five sessions of CHEM0010 taught by R. Fong from 1993 to 1998. While the numbers and method preclude rigorous statistical analysis, first hand inspection reveals a welcome trend.

TABLE 1

Average course grades in Fong's CHEM0010 1993-1997

Term	Enrolled	Failures	Average Grade	Web Site Activity
1993(W)	16	3	65%	none
1994(S)	10	0	66%	none
1996(S)	9	1	73%	study guide (sg)
1997(W)	6	0	70%	sg & tutorials
1997(S)	11	0	78%	sg, tutorials & assignments

(W = Winter, S = Summer)

Many factors may explain part of this trend including the maturity of the CHEM0010 course, and the experience of the instructor; however students have also commented favorably on the usefulness of the interactive study guide. In particular they cite its ability to help them focus and to bring resources together as making effective use of their study time.

- Sample student comments include:

> Web-based study guide is better than a text because of the ability to go quickly between information and problems and definitions etc. The web-site is a helpful supplement to the Chemistry course and I hope it will be around for my next courses. First time to come across such an impressive learning tool, an excellent model for other courses.

Of course, focussed study guides and weekly quizzes are not unique to web-based activity. Knowing what you are responsible to know or do, knowing of one's knowledge deficiencies, having frequent opportunity for guided practice, and having incentives to participate have long been principles of competency based instruction. Nor are these principles unique to computer-based media, similar results might have been expected had the weekly assignment been done on paper.

However, the web-based system offers a convenience to both instructor and students for developing, administering, marking and generating opportunities for individually guided practice that extends far beyond the restricted hours of the classroom. In addition, by working interactively the students enter into a learning conversation with the computer. They are attentive to the feedback and hints provided in the on-line assignments. They are free to continue their study and practice repetitively until they reach their personal goals. They can compare their progress with that of their classmates. Whether students are internally or externally motivated, the computerized study guide provides incentives to monitor and improve their understanding of Chemistry.

One student's comment reveals appreciation of the study guides ability to focus their effort.

> I am a weaker student, poor in math and I can use this study guide to preview each unit so that when it is presented in class the understanding and comprehension increases exponentially. The study guide is keyed to the course and therefore I am not spending a lot of time getting sidetracked reading other interesting but not relevant stuff in the text book. Also when you are logged on and are paying for the time online you go and get what you want or need and get off, so you are a lot more focused when you log on, as oppposed [sic] to when you pick up a text book.

The student went on to include a notion about the relevance of the media for valuing information on the computer versus traditional print media.

> And there is the argument for the youth of today that are very comfortable at a computer and maybe more so that [sic] with a large intimidating text book open in front of them.

CAN THE WEB-BASED STUDY GUIDE TEACH LEARNING STRATEGIES?

While the authors have no wish to discount the time and effort of the students, much of their increased success appears due to the provision of guidance, focus and motivation for mastery learning. This direction is well appreciated by the students because it makes it easier to know what and how to study. It enables early success and illustrates that good marks can in part be attributed to diligent and focussed study. For some of the pre-entry students this also contributes to early self-confidence and an expectation for success in this and future Chemistry courses.

Unfortunately not all courses, let alone all Chemistry courses are going to have the same degree of interactive guidance. Thus an argument could be made from the educational point of view, that while this degree of direction and focus is good for the acquisition of a knowledge base it might not contribute to the maturity of the student as a self-actuated learner. If student success becomes dependent upon an external agent, will the students learn to take responsibility for focussing, assessing and motivating themselves?

This has become an area of interest for the authors. We hope to follow the pre-entry students longitudinally to see if their early experiences in Chemistry set expectations for success and establish patterns for organization of learning. BCIT?s pre-entry program also contains a segment in the Communications course on study skills. Perhaps there is room for the integration of other study strategies

into interactive study guides to progressively move students towards more internally organized study strategies in preparation for less structured environments for learning.

ACKNOWLEDGMENTS

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